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Declass Review by NGA.

HPIC/TDS/D-679-67
9 February 1967

MEMORANDUM FOR: Director, National Photographic Interpretation Center

THROUGH : Chief, Support Staff, HPIC

SUBJECT : Request for Overrun [REDACTED]
[REDACTED]

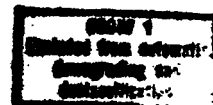
REFERENCE : Chief, Administration Staff, O/DDI Memorandum dated 4 February 1964: Approval of Research and Development Activities

1. In 1965, HPIC contracted with [REDACTED] for the development of a prototype Improved Anamorphic Viewing System under a CPIF contract for [REDACTED]

2. In a letter from the contractor, dated 2 February 1967, an overrun payment was requested because of unanticipated difficulties encountered in the fabrication. The difficulties simply amount to an original underestimation of the engineering and designing time required to complete this development, and preliminary evaluation has indicated that the ideas and concepts implemented in the anamorphic viewing system are of considerable value to HPIC. Concurrence for the action has been obtained through verbal conversations between [REDACTED]

IAH.

3. To avoid any future misunderstanding, qualification must be made to the contractor's statement "Your technical representative is aware that [REDACTED] manufactured an additional set of eyepieces on the subject contract." The contractor made the technical representative aware of this condition after they had manufactured the

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SUBJECT: Request for Overrun of [] from FY-1965 Funds
for Contract []

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eyepieces and found themselves in an overrun condition. As clearly indicated in the contract inspection reports, this condition was not revealed until 6 January 1967. This recommendation for approval of the overrun is conditioned on the acceptability, by the contracting officer, of the contractor's allocation of costs as outlined in his request for additional funds. It must be determined by our auditor that none of the cost of the second set of eyepieces is charged against our contract.

4. In accordance with the authority delegated in paragraph 3 of the reference, it is requested that the overrun of [] for Contract [] be approved and charged against FY-1965 funds. The Budget and Financial Branch has affirmed that sufficient FY-1965 funds are available to make this payment.

25X1

[]
Colonel, USAF

Assistant for Technical Development, NPIC

25X1

Attachment:

[] overrun request dated 2 February 1967

APPROVED:

ARTHUR C. LUNDAHL
Director, NPIC

Date

Distribution:

Orig & 1 - LB/SS/NPIC
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NPIC/TDS/DS []

February 1967)

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Attention: [REDACTED]

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Gentlemen:

[REDACTED] is pleased to submit, for your evaluation, a revised cost and technical proposal for an investigation leading to the design and manufacture of improved Anamorphic Eyepieces. This is an extension to our proposal dated February 24, 1965. Copies of the addendum to our technical proposal are enclosed.

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Our revised cost analysis is submitted on the attached sheet. As you will note, the total increase of our last proposal is [REDACTED]

The revision of our proposal reflects additional time for studying the problem. The delivery schedule for the proposed program is 14 months after receipt of a fully executed contract.

If you have any questions concerning this proposal, please contact the writer directly.

Very truly yours,

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[REDACTED]
Enc.

Contract Administrator
Photogrammetric Contracts Section

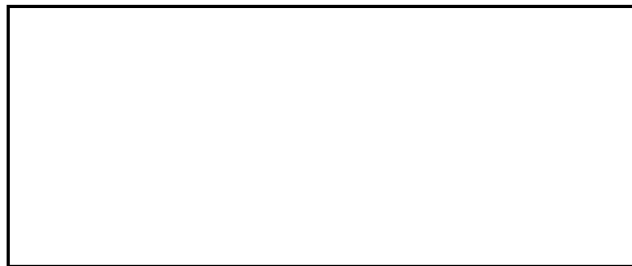
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Approved For Release 2004/11/30 : CIA-RDP78B04770A000400020006-1

Approved For Release 2004/11/30 : CIA-RDP78B04770A000400020006-1

Addendum to
Proposal for Study
Design and Manufacture
of Improved Variable Anamorphic
Eyepieces

March 1965



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1.0 SUMMARY

In a recent proposal entitled "Proposal for Study, Design and Manufacture of Improved Variable Anamorphic Eyepieces"

25X1 [] described a program to improve the original version of the variable anamorphic eyepiece. This proposal was restricted to consideration of devices that could be used interchangeably with the existing eyepieces of the Zoom 70 stereoscope. Further evaluation of the problem has indicated that it may be desirable to extend this program to include possible modification of the Zoom 70 stereoscope. This addendum to that proposal describes an expanded area of study to include such possible modification.

2.0 TECHNICAL DISCUSSION

25X1 The existing variable anamorphic eyepiece system designed and built by [] had as a design objective interchangeability with a normal eyepiece. This objective was met, but at the expense of a relatively heavy, long, and somewhat cumbersome unit. Considerable thought has been given to the problem of reducing these disadvantages. The primary problem is that to minimize aberrations the anamorphic system must work in collimated light, and achievement of this collimation adds considerable length. For instance, in the existing system the actual zoom anamorphic components take up only about one-third the length of the system. There exists a real possibility of achieving this collimation, and required anamorphism, without undue extension of eyepoint if the stereoscope itself were modified. It is therefore proposed that the study portion of the above referenced proposal be expanded to include determination of an optimum modification of the Zoom 70 stereoscope for anamorphic application.

3.0 PROPOSED PROGRAM

It is proposed that three levels of Zoom 70 modification be considered. These are described in the following sections.

3.1 CUSTOMER MODIFICATION

The first level of modification to be considered will be simple removal of existing parts that can be done in the field by anyone familiar with the instrument who is given detailed instructions for such modification. Such modification might consist of removal of the existing eyepiece support cones, removal of the dust cover at the bottom of the eyepiece receptacle, etc.

There exists a possibility that such modification may permit use of a negative collimating lens inside the Zoom 70 so that the basic principles of the present system can be used but with a considerable reduction in eyepoint extension. This will be investigated.

3.2 FACTORY MODIFICATION

25X1 The second level of modification to be investigated will be a major modification of the optical train of the Zoom 70 without major mechanical modification. At this level of modification the instruments would have to be returned to for modification. After modification they would no longer be useful for conventional stereoviewing applications. However, it will be an essential goal of the study to assure that the cost of such modification is at most one half the cost of the Zoom 70.

Possible modifications of this type would be replacement of the existing mirror cluster by some other mirror system, or even replacement of fixed components in the optical system itself. If advantageous and mechanically feasible optical components may be added to the system.

3.3. COMPLETE REDESIGN

The third level of modification to be considered will be complete redesign of the mechanics of the Zoom 70 system. The basic optical system will be retained since it has proven so satisfactory throughout its many years of use.

It is quite conceivable that the resulting instrument would in no way resemble the existing Zoom 70 in appearance.


Here the design objective will be to devise a unit that in comparable quantity production costs less than the present Zoom 70 with added anamorphic eyepieces.

4.0 WORK STATEMENT

This work statement is an addendum to the work statement given in the proposal referenced in section 1. All portions of the previous work statement are applicable and the following items may be considered as added on to that one.

1. Consider the possibility of achieving variable anamorphism by simple modification of the Zoom 70. Such modification will be capable of being done in the field by personnel familiar with the unit with the aid of instructions to be furnished by



2. Study the feasibility of major modification of the existing Zoom 70. This modification would require returning the instrument to  The design goal of this modification will be to keep the cost of such modification one half or less of the current cost of a new unit.

3. Study the feasibility of complete redesign of the Zoom 70 for variable anamorphic operation. In this modification the only restriction will be to use the same basic optical system that is currently used.

4. Consideration will be restricted to those systems working only from unity upward. No consideration will be given to systems working both sides of unity such as for example .7 to 1.4.

5.0 PROGRAM SCHEDULE

It is currently anticipated that this added work will extend the previously proposed schedule for the study phase of this program by three months. Thus the new total elapsed time for the study phase of the program will be six months.

**Proposal for Study
Design and Manufacture
of Improved Variable Anamorphic
Eyepieces**

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1.0 INTRODUCTION

In response to a recent request for eyepieces having variable anamorphic magnification, [] designed a first model Variable Anamorphic Eyepiece. This instrument is comprised basically of three parts, (1) a collimator, (2) an afocal anamorphic zoom system composed of cylinder lenses, and (3) a collective lens plus conventional eyepiece. It has two basic faults. First, the image is inverted. Second, it is large and bulky. It raises the level of the eyepiece $5\frac{1}{2}$ inches, necessitating a bend in the optical train to achieve a reasonable interpupillary distance and a higher than normal chair for the operator. It is desirable to design a system which will not have these faults.

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Study of means of eliminating these faults has shown that no simple solution exists. The present proposed program consists of an initial study phase^① in which various approaches will be evaluated in terms of estimated optical performance (detailed optical design study will not be done during this phase) and mechanical configuration. On the basis of this study one system^② will be chosen, a complete optical mechanical design effort will be performed, and a pair of eyepieces manufactured.^③ } II

PHASES

2.0 TECHNICAL DISCUSSION

The Mod I Variable Anamorphic Eyepieces were designed to be used on the Zoom 70. However, there are indications that the variable anamorphic concept is useful on a variety of stereoviewers. This presents a problem since the Zoom 95, Zoom 70, and High Power StereoViewer do not all have the same mechanical clearances in the vicinity of the eyepiece. Because spatial limitations are very important in this problem, it may be that no one solution

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will be applicable to all stereo instruments. The following discussion will be concerned with obtaining anamorphic magnification with the Zoom 70, but the results of the study to be proposed will be very useful in devising similar instrumentation for the other stereo viewing equipment.

In the proposal which led to the development of the Mod I Variable Anamorphic Eyepieces, three methods for obtaining variable anamorphic magnifying power were discussed. Briefly, they are as follows:

- (1) Tilting prisms.
- (2) Zoom system of cylinder lenses.
- (3) System of counter rotating cylinders.

All three have one thing in common, and that is that they operate in collimated light. The only practical collimator for these systems is a positive eyepiece type lens near the eyepiece focal plane of the Zoom 70. In order to see the image carried by the collimated light it is necessary to add to the system an objective lens to form the image. This is the source of one of our problems for the image formed by the collimator-objective combination is inverted. If a negative collimating lens could be used, the image would be erect. But, the use of a negative collimator lens would result in a large loss in field coverage unless the lens could be placed far down in the Zoom 70. It would be necessary to modify the Zoom 70 to do this.

To construct a variable anamorphic system having the required erect image, one of three things must be done.

1. Construct a compact positive magnification variable anamorphic eyepiece which will work in converging light.

2. Construct a system similar to the Mod I eyepiece adding an erecting system such as a pechan prism or an erecting telescope.
3. Modify the existing zoom 70 to obtain a narrow beam of collimated light in which an anamorphic system can be placed, followed by a telescope to form an erect image.

2.1 Optical Requirements

The eyepieces can be considered as having two meridians, parallel to the axis and mutually perpendicular, one being the plane in which the magnification is varied, the other being the plane in which the magnification is fixed. Each meridian can be considered as having its own exit pupil and its own image plane. If the central image is to be free from astigmatism, the two image planes must coincide exactly. This means that when zoom systems are used only mechanically compensated zoom systems will work. Similarly if the whole field is to be seen at once the two pupils must be in reasonable coincidence. The first part of the problem is to find systems in which these two conditions are met.

While a number of systems meeting these requirements have been developed in gross concept, efforts to date to design them into a reasonable size package have been unsuccessful. This problem would be alleviated if the requirement for a collimating lens could be removed. ~~This~~ one aspect of the study phase will be a detailed examination of the deleterious effects of non-collimated light on the various configurations so far considered.

3.0 PROPOSED FEASIBILITY STUDY

25X1 proposes to study the feasibility of different types of systems described as follows:

3.1 Cylindrical Zoom (Figure 1)

Vary the anamorphic magnification of the image in the eyepiece focal plane by means of a suitable cylinder zoom system. Adjust the location of the exit pupil by means of a suitable fixed magnification cylinder relay located as shown in Figure 1, and view the image with a long focal length eye lens (say 5x).

Prior investigation of such a system has indicated that thin lens wise such a system is possible, but that the anamorphic ratio might have to be variable from something like .7 to 1.54 rather than the desired 1 to 2.2. In use this means that images would be compressed and stretched to bring them into stereo fusion rather than merely stretched as the current specifications imply.

Only one of many possible zoom systems of this type has been considered, and a search will be conducted to see if a more suitable first order configuration can be found.

3.2 Cylindrical Eyepiece (Figure 2)

Construct an eyepiece completely of crossed cylinders fixed in one meridian and variable in the other.

Relatively compact zoom systems exist in which the object is an aerial image and the image is vertical and formed at a considerable distance from the object. In other words the zoom system works as a variable

power eyepiece. It may be possible to construct such a zoom system of cylinder lenses and intersperse among or around the cylinder lenses other fixed cylinder lens oriented at 90° to the zoom system in such a way that the net effect will be in one case that of an eyepiece composed of spherical lenses. Inasmuch as crossed cylinders must be used in System 1, System 2 would be no more complicated and might prove to have a more favorable range of anamorphic ratios. It also might prove to be a shorter system.

3.3 Prism Anamorphism (Figure 3)

Vary the anamorphic ratio of the eyepiece focal plane image by means of a prism anamorphic system and view this image with a suitable eyepiece lens.

At first glance, since no collimating lens is used this method appears impossible because this eyepiece must work in converging light, and prism systems of this sort work only in collimated light. However, it may be possible to back the prism system up with a weak cylinder system to correct the aberrations introduced by the prisms.

The prism system has one advantage over the cylinder lens system which should not be overlooked and this is that the alignment of prism systems is not nearly as critical as the alignment of cylinder systems, therefore, unless cylinder systems offer some distinct advantage over prism systems (e.g. a shorter overall length) prism systems are preferable.

3.4 Folded System (Figure 4)

Build a device similar to the current variable anamorphic eyepieces consisting of a collimator, a plano mirror, a zoom cylinder system, a telescope objective which combined with the collimator will make a unit power relay, an image rotation device such as a pechan prism, and an eyepiece.

The length of this arrangement is prohibitive if it is run straight up from the eyepiece mount. To eliminate this problem the unit would be bent with a mirror to extend over the power pod of the stereoscope. Two configurations are possible. The first is a single bend over the pod necessitating turning the stereoscope 180° for use. The second has an initial bend over the pod and is then again folded back so that the viewing end of the unit is approximately in the normal position.

Either approach would result in a unit too heavy to be supported by the eyepiece tube and design for additional support from the top of the pod will be necessary. In doing this access to the stereozoom controls must be maintained.

This approach has the advantage that the current zoom system could be used. Its success will depend on whether the space required for folding and for components to erect the image can be obtained without excessive loss of field.

3.5 Prism Modification (Figure 5)

In the system described in 3.4 overall length need not be constrained as much as it was in the first version of the variable anamorphic eyepiece. Therefore,

a system of four tilting prisms introducing an anamorphic range of 5:1 to 1.5:1 or combined with a cylinder systemed to give a range 1:1 to 3:1 might be possible.

Essentially the same as described in Section 3.4 this system takes advantage of the less critical alignment requirements of the prism method of achieving anamorphism.

4.0 WORK STATEMENT

25X1 will conduct a study of the various types of anamorphic eyepiece systems described in Section 3. On the basis of this study the best system will be selected. This best system will then be carried through final design and a pair of eyepieces manufactured to this design.

Monthly progress reports will be furnished. At the end of the study phase a report summarizing the results of the study will be submitted.

Design goals for the New Variable Anamorphic Eyepieces will be as follows:

1. Basic eyepiece magnification of 5x and/or 10x with variable anamorphic ratio from 1:1 to 1:2.2 (more if possible). Anamorphic ratios of less than 1 will be considered.
2. The maximum acceptable loss of field will be 15%.
3. Anamorphic direction will be adjustable through 360°.
4. The loss in resolving power on axis will be no more than 20% as compared with a normal eyepiece of comparable magnifying power. Every effort will be made

to improve off axis image performance.

5. The new Variable Anamorphic Eyepieces will not increase the height of the eyepoint more than 4 inches above the normal eyepoint position for the Zoom 70.

5.0 PROGRAM SCHEDULE

The time required for completion of the program described in Section 4. will be as follows:

Preliminary design study	6.3 months
Final design	4 months
Manufacture	4 months
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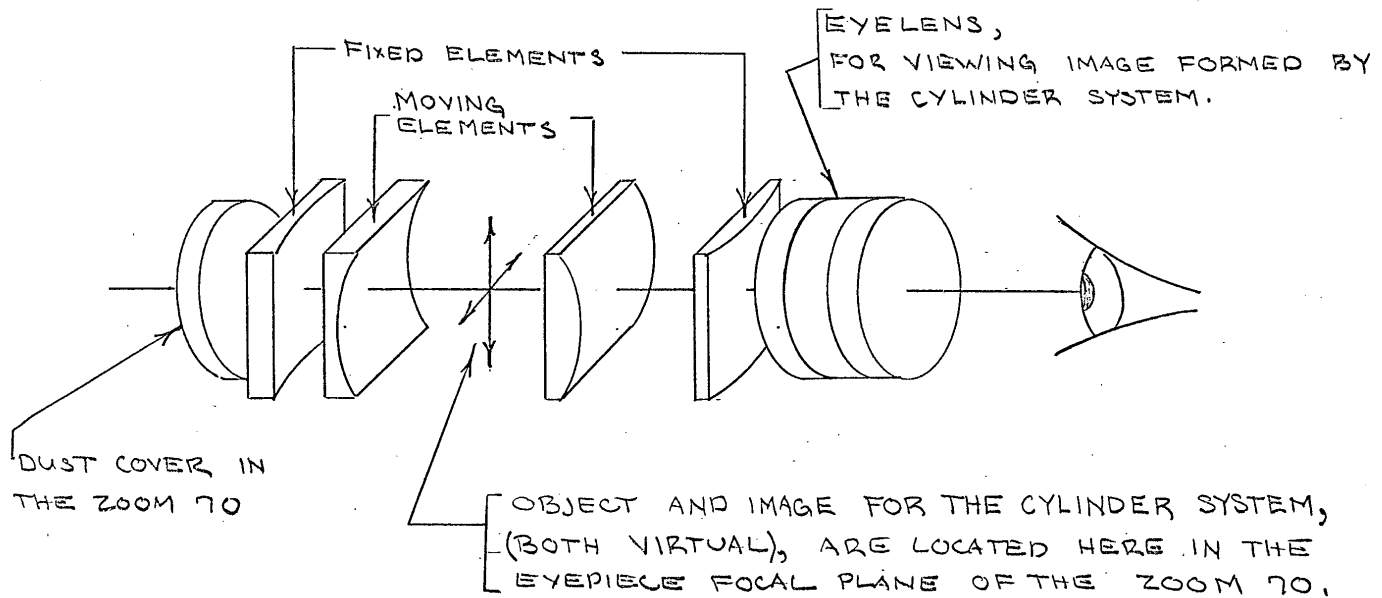


FIGURE 1 CYLINDRICAL ZOOM

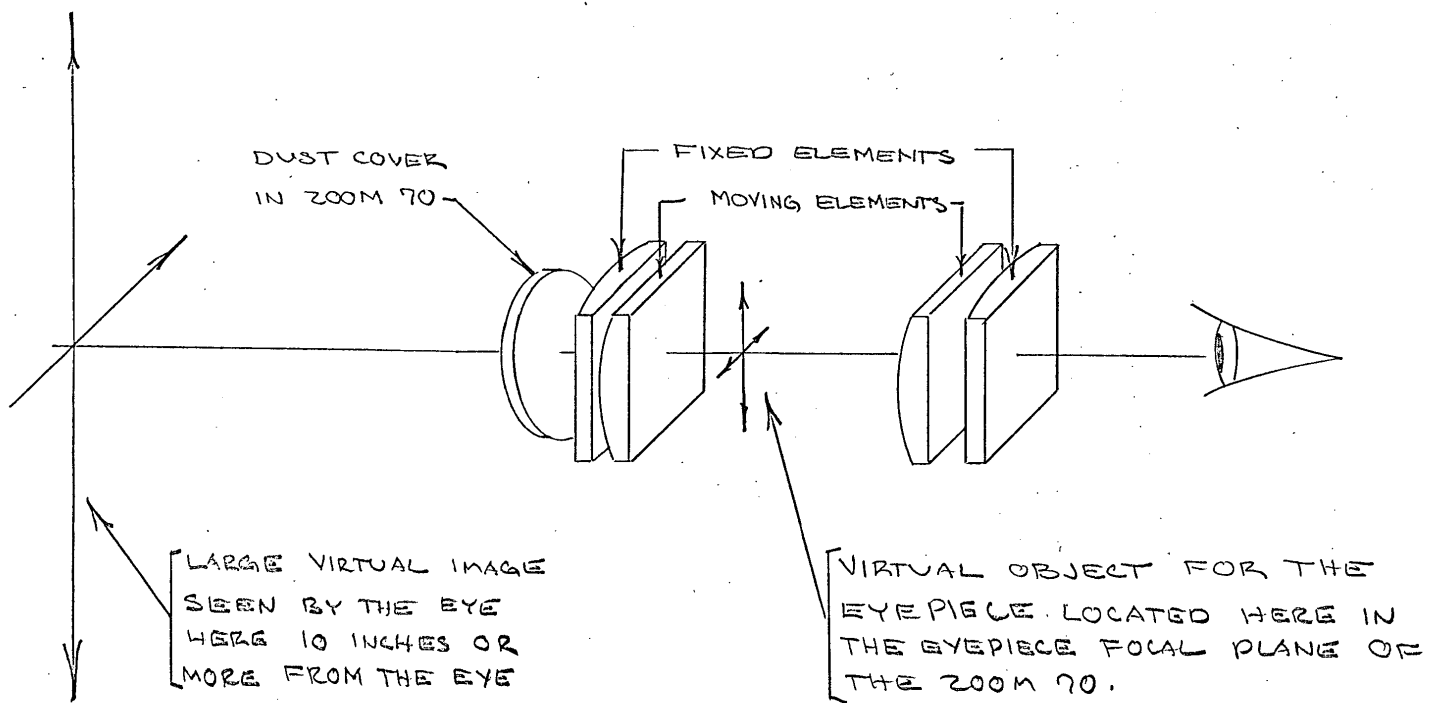


FIGURE 2 CYLINDRICAL EYEPIECE

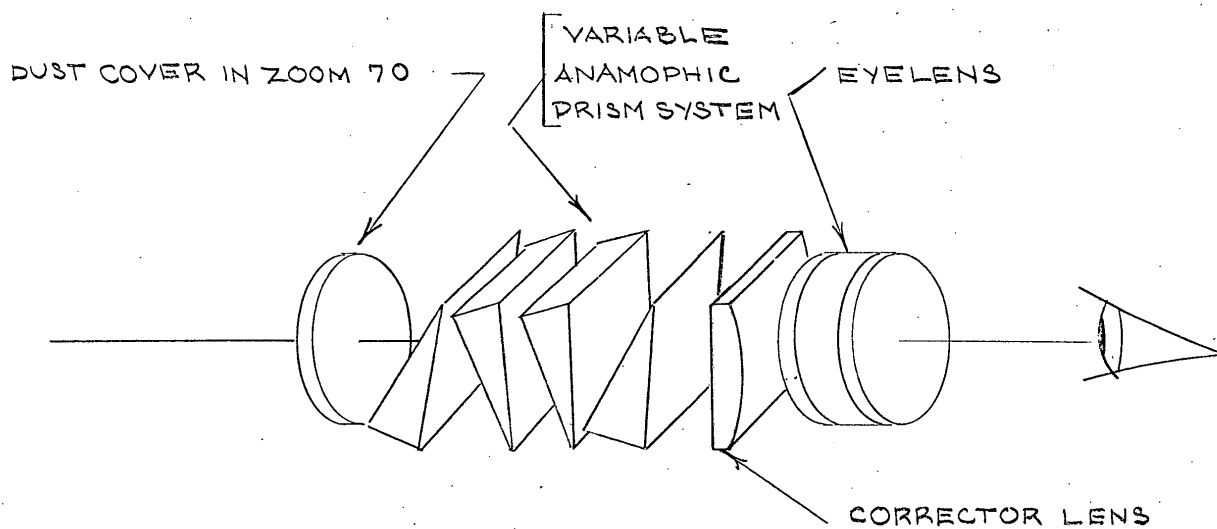


FIGURE 3 PRISM ANAMORPHISM

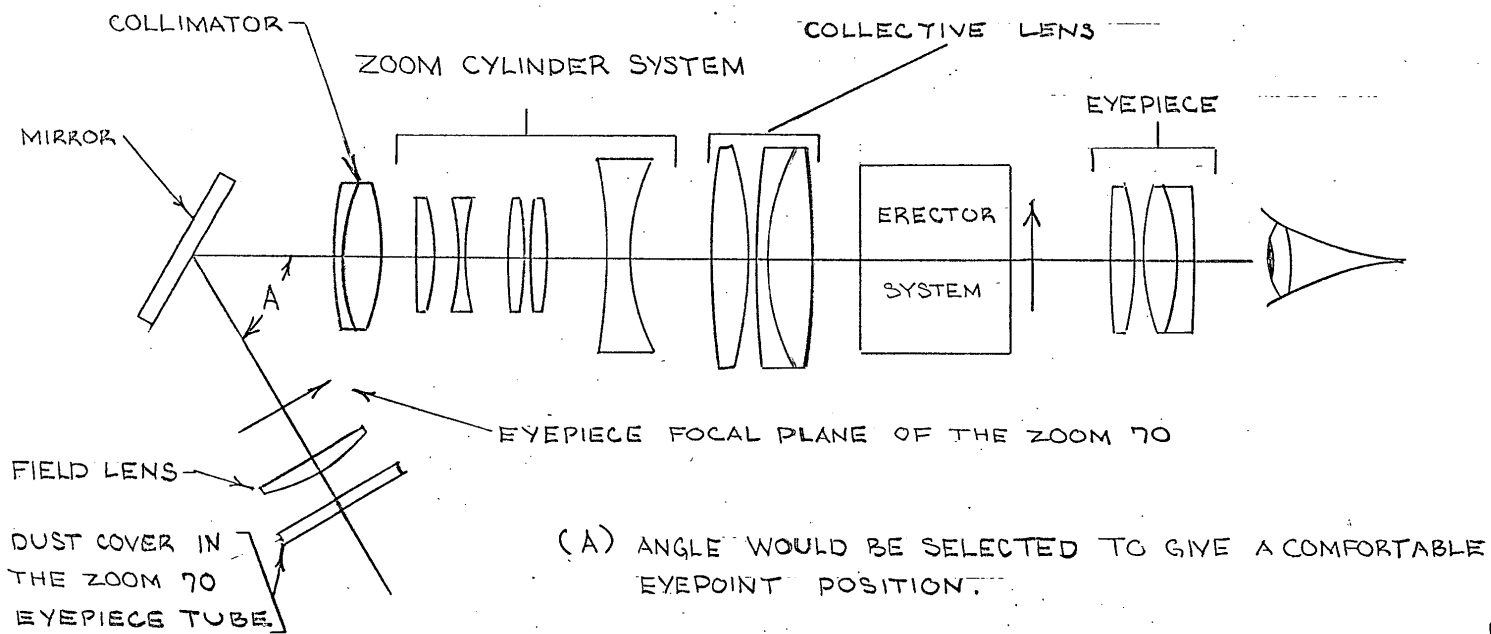


FIGURE 4 FOLDED SYSTEM

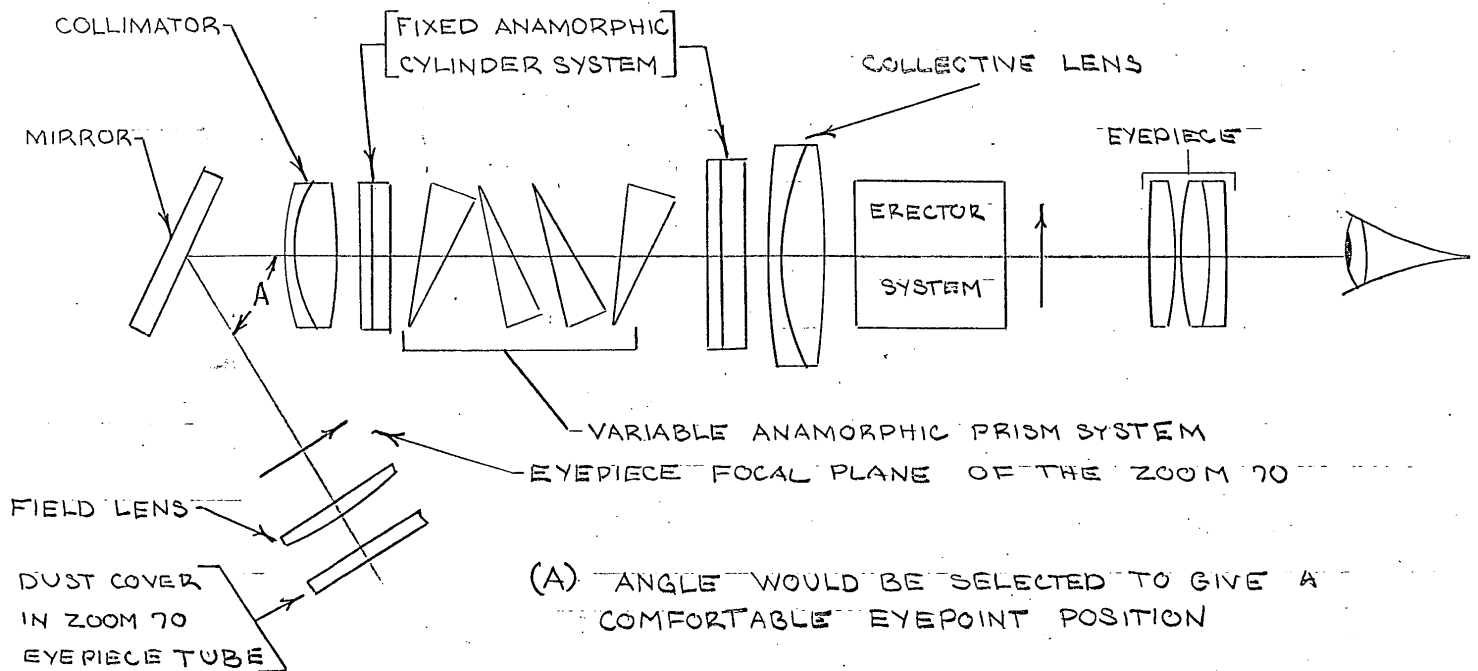


FIGURE 5 PRISM MODIFICATION
OF THE FOLDED SYSTEM